# Efficient RFID Tag Placement Framework for In Building Navigation System for the Blind

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*Abstract*— **To date, there are increasing buildings with complex design, multi-storey and with large-scaled area. The complicated building layout could lead to certain level of difficulties for the blind or the visually impaired people in path identification in an unfamiliar surrounding such as in a new shopping complex. Radio Frequency Identification (RFID) technology appeared as an effective solution to provide location-based information to the visually impaired or blind people in indoor environment. However, RFID tags placement which can provide high positional accuracy will become an issue in effective deployment of large-scaled RFID network in a large building. This can be a very time consuming process and it is too costly to estimate the required number of RFID tags manually. In addition, the vendors do not have a standard framework or guideline in determining the tag placement process optimally. Without knowing the meaning of tag placement which provides useful location information and effective detection for the visually impaired or blind person could cause inaccurately aiding them in navigation in a large-scaled building. Therefore, a framework with automatic suggestion of intelligent optimization for RFID tags placement in a large building will be proposed in order to effectively implement RFID based navigation network for the building in terms of cost effectiveness. This framework will become the guideline to create a friendly environment for visually impaired person enabling them to enjoy high mobility in any multi-storey or large building.**

***Keywords-component; indoor navigation system; RFID; blind; tag placement;***

## I. INTRODUCTION

Human beings desire to live in a civil environment where everyone can move around freely regardless of their characteristics including these with physical disabilities such as the blind or the visually impaired. Navigation from one place to another involves locating and avoiding obstacles, staying on the correct pathways, locating doorways or tracking the present location have become a headache issue for the visually impaired [1]. Person with severe visual impairments used to reach their destination based on their mental map in which they need times to memorize those routes. Wayfinding is a technique that the blind or the visual impaired people used in order to move from one place to another independently and safely. This technique answers two basic questions: Where am I? and Which way should I go? The way they question themselves are not efficient in aiding them forming an effective mental map when they have not enough information about the unfamiliar surroundings especially in environments with free flowing traffic such as in the airport concourse, parking lots, malls, complexes and campuses. Even there are some of wide open spaces such as airport concourse are full of Braille signs at the counters, but the blind may not even find them. Generally, the widely used aid tools such as white cane, Sonicguide™, and guide dog offer little wayfinding assistance as according to [1] where they just able to give a little navigation aiding to the blind. In addition, some shopping malls provide building maps which are only useful for those can see and read the display. However, many medical and academic buildings are lack of such navigation assistance. Those environment are challenging even for the sighted person, because a normal pedestrian cannot even find their destination, needless to say the visually impaired.

For outdoor navigation several systems have been proposed or are commercially available [5, 6, 7, 8]. These systems use different technologies to provide common characteristics of navigation aid. The main technologies used include GIS, GPS, radar, ultrasonic, speech and RFID technology. In the study of [5, 6], they integrated both GIS and GPS for positioning and tracking and given sound. L.Ran et al. [6] proposed combination of GIS and GPS navigation system by added a sonar device to detect obstacle.

However, GPS signal are absent due to blocking by concrete walls or greatly attenuated by bad condition of indoor environment such as severe fading and multipath. GPS-based navigation system is no longer effective in providing positional information to blind travellers inside a building. As a solution for indoor navigation assistance in an unfavourable situation and obstacle-laden site, RFID appeared as a powerful means of replacing the GPS signal if the distributions of RFID tags are implemented efficiently and meaningfully for the blind. To further understand the importance of RFID technology, a brief explanation about RFID technology is given. RFID technology is a method for remotely storing and retrieving data using devices called RFID tags or transponders. There are two different types of tag, passive and active. Passive RFID tags do not have a built in power supply and the active one has its own power supply. In order to deploy a RFID-based navigation network within a building which is